# COOLING SYSTEM, SERVICING

## COOLING SYSTEM, GENERAL INFORMATION

**WARNING:** **When performing repair work, especially due to the confined conditions in the engine compartment, pay attention to the following:**

- **Route all types of lines (e.g. for fuel, hydraulics, EVAP system, coolant, refrigerant, brake fluid and vacuum) as well as electrical wiring so that the original positions are restored.**
- **Ensure sufficient clearance to all moving or hot components.**

**NOTE:**

- **When the engine is warm the cooling system is under pressure. If necessary release the pressure before beginning repair work.**
- **Hoses are secured with spring-type clamps. In cases of repair only use spring-type clamps.**
- **Assembly tool VAS 5024 or hose clip pliers V.A.G 1921 are recommended for installing spring-type clamps.**

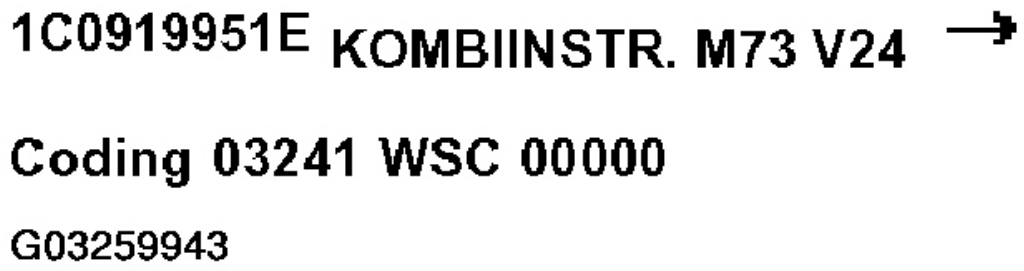


**Fig. 1: Identifying Special Tools**
**Courtesy of VOLKSWAGEN OF AMERICA, INC.**

- **When installing coolant hoses route stress-free so that they do not come into contact with other components (observe markings on coolant connection and hose).**

Perform cooling system leakage test with cooling system tester V.A.G 1274 and adapters V.A.G 1274/8 and

V.A.G 1274/9.

Components of cooling system body side, See **COOLING SYSTEM COMPONENTS - BODY SIDE, REMOVING AND INSTALLING** .

Components of cooling system engine side, See **COOLING SYSTEM COMPONENTS - ENGINE SIDE, REMOVING AND INSTALLING** .

Coolant hose connection diagram, See **COOLANT HOSE CONNECTION DIAGRAM**

Draining and filling with coolant, See **COOLING SYSTEM, DRAINING AND FILLING** .

Coolant mixing ratios, See **COOLING SYSTEM, DRAINING AND FILLING**

**COOLING SYSTEM COMPONENTS - BODY SIDE, REMOVING AND INSTALLING**

**NOTE: Coolant hose connection diagram, See COOLANT HOSE CONNECTION DIAGRAM**

**NOTE: The following list refers to items in Fig. 2 .**

1. **Radiator**
   - Removing and installing, See **RADIATOR, REMOVING AND INSTALLING**
   - After replacement replace entire coolant amount
2. **O-ring**
   - Replace
3. **Upper coolant hose**
   - Secured to radiator with retaining clip
   - Coolant hose connection diagram, See **COOLANT HOSE CONNECTION DIAGRAM**
4. **4 N.m**
5. **Cover**
   - Check with cooling system tester V.A.G1274 and adapter V.A.G 1274/9
   - Pressure relief valve must open at a pressure of 1.4...1.6 bar
6. **2 N.m**
7. **Expansion tank**
   - Perform leak test on cooling system with cooling system tester V.A.G 1274 and adapter V.A.G1274/8
   - Test pressure 1.4...1.6 bar
   - Observe markings, See **COOLING SYSTEM, DRAINING AND FILLING**
8. **Connector**
9. **To coolant pipe**

- Coolant hose connection diagram, See **COOLANT HOSE CONNECTION DIAGRAM**

10. **Air ducting**
11. **10 N.m**
12. **Right coolant fan -V35-**
    - Only models with optional equipment
    - Checking, See **COOLANT FAN, CHECKING**
    - Removing and installing, See **RADIATOR, REMOVING AND INSTALLING**
13. **Fan ring**
    - For right coolant fan
14. **Retaining clip**
    - Check if seated securely
15. **Fan ring**
16. **Coolant fan - V7-**
    - Checking, See **COOLANT FAN, CHECKING**
    - Removing and installing, See **RADIATOR, REMOVING AND INSTALLING**
17. **Retainer**
    - For coolant fan connector
18. **Lower coolant hose**
    - Secured to radiator with retaining clip
    - Coolant hose connection diagram, See **COOLANT HOSE CONNECTION DIAGRAM**
    - Check if seated securely
19. **Coolant Fan Control (FC) thermal switch -F18-, 35 N.m**
    - For electric fan
    - Switching temperatures: 1. stage on: 92...97°C, off: 84...91°C; 2. stage on: 99...105 C, off: 91...98° C
20. **Retainer**
    - For bottom of radiator
21. **Retainer**
    - For top of radiator
    - Observe installed position

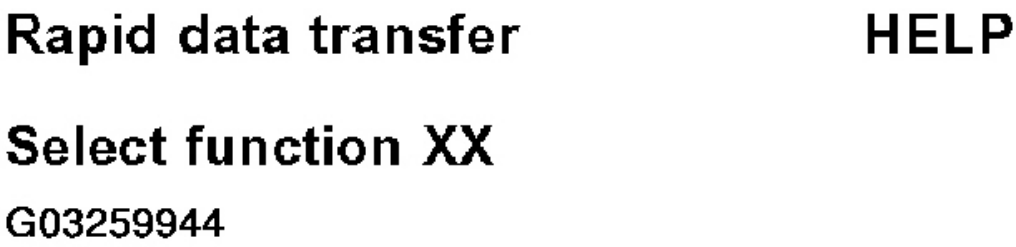


**Fig. 2: Exploded View Of Body Side Cooling System Components**
**Courtesy of VOLKSWAGEN OF AMERICA, INC.**

**COOLING SYSTEM COMPONENTS -ENGINE SIDE, REMOVING AND INSTALLING**

**NOTE:** **Coolant hose connection diagram, See COOLANT HOSE CONNECTION DIAGRAM**

**NOTE:** **The following list refers to items in Fig. 3 .**

1. **Heating system heat exchanger**
2. **Connector**
   - 4-pin
   - Gold plated contacts for ECT sensor - G62-
3. **Engine Coolant Temperature (ECT) sensor -G62-**
   - For engine control module
   - With ECT sensor -G2-
   - Gold plated contacts for ECT sensor -G62-
   - Release pressure in cooling system if necessary before removing components
4. **Connector**
   - 2-pin
   - Only for engine code AEG until Model Year 1999
   - Only vehicles with air conditioner with 4-pin A/C Pressure Switch -F129-
5. **A/C cut-out thermal switch -F163-**
   - Only for engine code AEG until Model Year 1999
   - Only vehicles with air conditioner with 4-pin A/C Pressure Switch -F129-
   - Vehicles with air conditioner only, otherwise blind plug
6. **Coolant pipe**

- Coolant hose connection diagram, See **COOLANT HOSE CONNECTION DIAGRAM**

7. **Retaining clip**
   - Check if seated securely
8. **10 N.m**
9. **To bottom of expansion tank**
   - Coolant hose connection diagram, See **COOLANT HOSE CONNECTION DIAGRAM**
10. **To top of radiator**
    - Coolant hose connection diagram, See **COOLANT HOSE CONNECTION DIAGRAM**
11. **O-ring**
    - Replace
12. **Connecting unions**
13. **To bottom of radiator**
    - Coolant hose connection diagram, See **COOLANT HOSE CONNECTION DIAGRAM**
14. **Oil cooler**
    - Removing and installing, See **PART II (OIL FILTER HOUSING, DISASSEMBLING AND ASSEMBLING)** .
15. **15 N.m**
16. **Coolant thermostat**
    - Checking: Heat up thermostat in water
    - Starts to open: approx. 86°C
    - Opening stroke: min. 7 mm
    - Removing and installing, See **THERMOSTAT, REMOVING AND INSTALLING**
17. **Toothed belt**
    - Mark direction of rotation before removing
    - Check for wear
    - Do not kink
    - Removing, installing and tensioning. See **TOOTHED BELTS, REMOVING, INSTALLING AND TENSIONING** .
18. **Coolant pump**
    - Check for ease of movement
    - If damaged or leaking replace complete
    - Removing and installing, See **COOLANT PUMP, REMOVING AND INSTALLING**
19. **Rear toothed belt guard**
20. **20 N.m**
21. **Throttle valve control module**
    - Heated by coolant
    - Coolant hose connection diagram, See **COOLANT HOSE CONNECTION DIAGRAM**
22. **To top of expansion tank**

- Coolant hose connection diagram, See **COOLANT HOSE CONNECTION DIAGRAM**

23. **O-ring**
    - Replace if damaged

**Fig. 3: Exploded View Of Engine Side Cooling System Components**
**Courtesy of VOLKSWAGEN OF AMERICA, INC.**

**COOLANT HOSE CONNECTION DIAGRAM**

**Engine code AEG (up to Model Year 1998)**

**NOTE: Engine codes AEG (from Model Year 1999), AVH, AZG, BDC, BEV, BGD, see ENGINE CODES AEG (FROM MODEL YEAR 1999), AVH, AZG, BDC, BEV, BGD .**

**NOTE: The following list refers to items in Fig. 4 .**

1. **Radiator**
2. **Oil cooler**
3. **Coolant pump/coolant thermostat**
4. **Cylinder head/cylinder block**
5. **Expansion tank**
6. **Intake manifold**
7. **Throttle valve control module**
8. **Union**
9. **Heating system heat exchanger**
10. **Coolant pipe**
11. **ATF cooler**
    - Only models with an automatic transmission

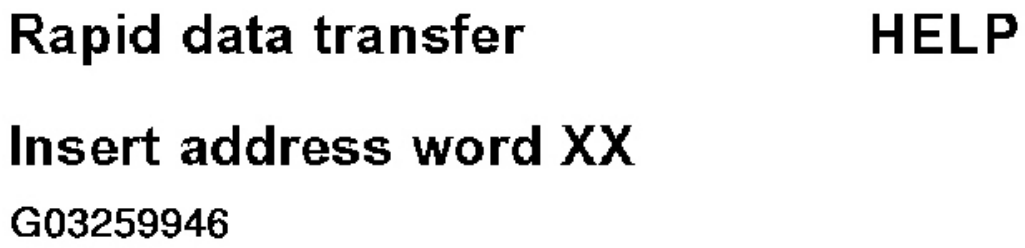


**Fig. 4: Coolant Hose Connection Diagram (Engine Code AEG Up To Model Year 1998)**
**Courtesy of VOLKSWAGEN OF AMERICA, INC.**

**Engine codes AEG (from Model Year 1999), AVH, AZG, BDC, BEV, BGD**

**NOTE: The following list refers to items in Fig. 5 .**

1. **Radiator**
2. **Oil cooler**
3. **Coolant pump/coolant thermostat**
4. **Cylinder head/cylinder block**
5. **Expansion tank**
6. **Intake manifold**
7. **Throttle valve control module**
8. **Connecting unions**
9. **Heating system heat exchanger**
10. **Quick-action coupling**
11. **Coolant pipe**
12. **ATF cooler**
    - Only models with an automatic transmission

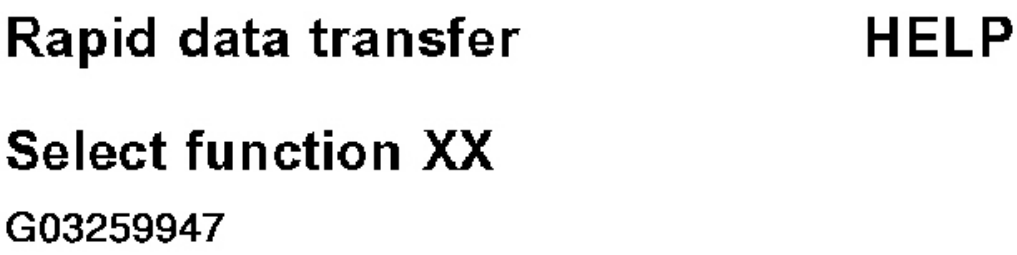


**Fig. 5: Coolant Hose Connection Diagram (Engine Codes AEG From Model Year 1999, AVH, AZG, BDC, BEV, BGD)**
**Courtesy of VOLKSWAGEN OF AMERICA, INC.**

**COOLING SYSTEM, DRAINING AND FILLING**

**Special tools, equipment, testers, measuring instruments and auxiliary items required**

- T10007 Refractometer
- V.A.G 1306 Drip tray
- Torque wrench VAG 1331
- VAS 5024 Assembly tool for spring-type clamps
- Adapter for expansion tank VAG 1274/8
- VAS 6096 Coolant system charging unit

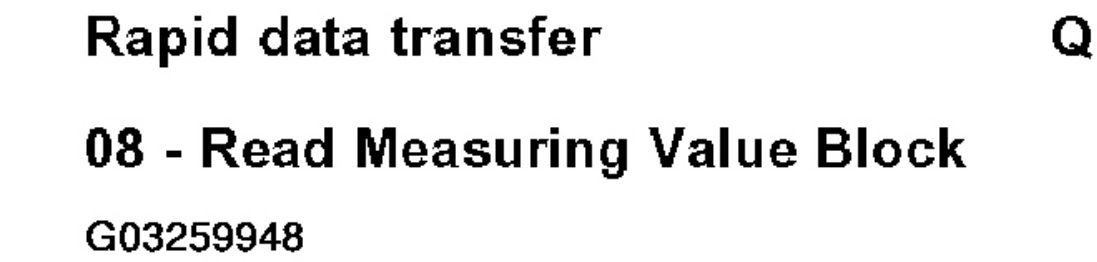


**Fig. 6: Identifying Special Tools**
**Courtesy of VOLKSWAGEN OF AMERICA, INC.**

**Draining**

**WARNING: Steam can be released when removing the cap from the expansion tank. Cover the cap with a cloth and open carefully.**

- Open cap on coolant expansion tank.
- Remove sound insulation tray:

  See **NOISE INSULATION, ASSEMBLY OVERVIEW** .

- Place drip tray VAG 1306 under vehicle.
- Remove drain plug (arrow) to drain coolant from radiator.

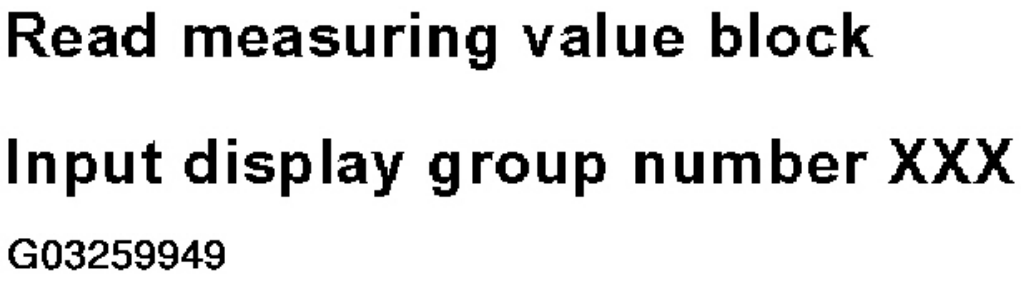


**Fig. 7: Removing Radiator Drain Plug**
**Courtesy of VOLKSWAGEN OF AMERICA, INC.**

- Remove coolant hose from oil cooler (arrow) to drain coolant from engine.

**NOTE: Observe waste disposal regulations!**

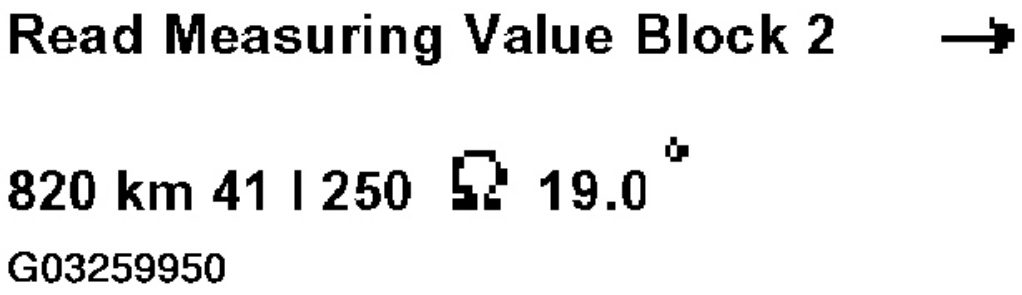


**Fig. 8: Removing Coolant Hose From Oil Cooler**
**Courtesy of VOLKSWAGEN OF AMERICA, INC.**

**Filling**

**NOTE:**

- **Only use coolant additive G 12 in accordance with TL VW 774 F. Distinguishing color: violet**
- **G 12 and coolant additives marked "In accordance with TL VW 774 F" prevent frost and corrosion damage, scaling and also raise boiling point of coolant. For this reason the system must be filled all year round with frost and corrosion protection additives.**
- **G 12 (according to TL VW 774 F) can be mixed with coolant additive G12 which is colored red.**
- **Because of its high boiling point, the coolant improves engine reliability under heavy loads, particularly in countries with tropical climates.**
- **Protection against frost must be assured to about -25° C (in arctic climatic countries to about -35° C).**
- **The coolant concentration must not be reduced by adding water even in warmer seasons and in warmer countries. The anti-freeze ratio must be at least 40%.**
- **If for climatic reasons a higher anti-freeze is required, the amount of G 12 can be increased, but only up to 60% (anti-freeze to about -40° C), as otherwise antifreeze is reduced again and cooling effectiveness is also reduced.**
- **Refractometer T 10007 is recommended to determine coolant freezing temperature.**

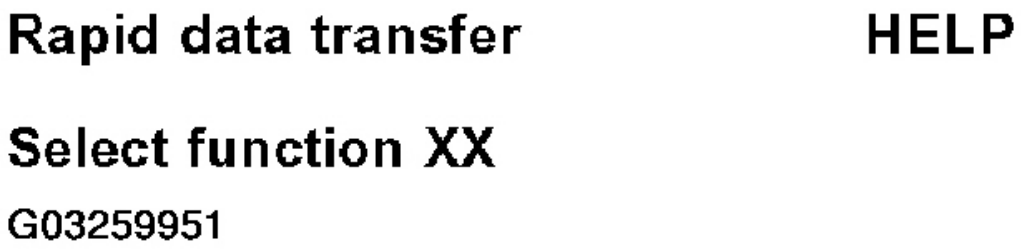


**Fig. 9: Identifying Refractometer T 10007**
**Courtesy of VOLKSWAGEN OF AMERICA, INC.**

- **If radiator, heat exchanger, cylinder head or cylinder head gasket is replaced, do not reuse old coolant.**

Recommended mixture ratios:

**RECOMMENDED MIXTURE RATIOS SPECIFICATIONS**

| Antifreeze to | Anti-freeze proportion | G 12(1) | (1) , (2) Water |
|---|---|---|---|
| -25° C - | 40% | 2.0 I | 3.0 I |
| -35° C | 50% | 2.5 I | 2.5 I |
| (1) The quantity of coolant can vary in depending on the level of vehicle equipment. | | | |
| (2) Use only clean drinking water. | | | |

**Work sequence**

- Screw drain plug into radiator.
- Push coolant hose onto oil cooler connection and secure with a spring-type clamp.

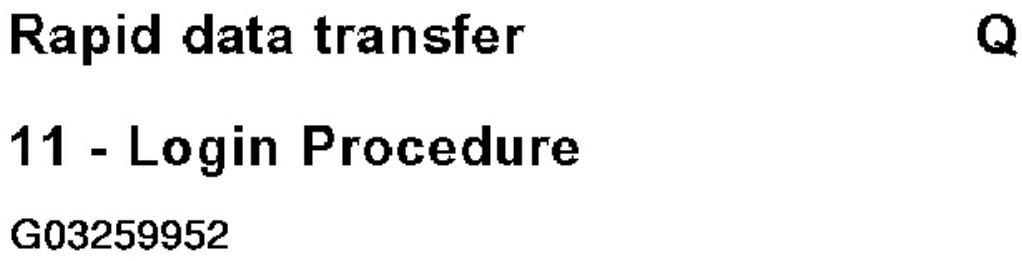


**Fig. 10: Pushing Coolant Hose Onto Oil Cooler Connection And Securing With Spring-Type Clamp**
**Courtesy of VOLKSWAGEN OF AMERICA, INC.**

**Vehicles with max. expansion tank marking**

- Fill with coolant up to max. mark on expansion tank.

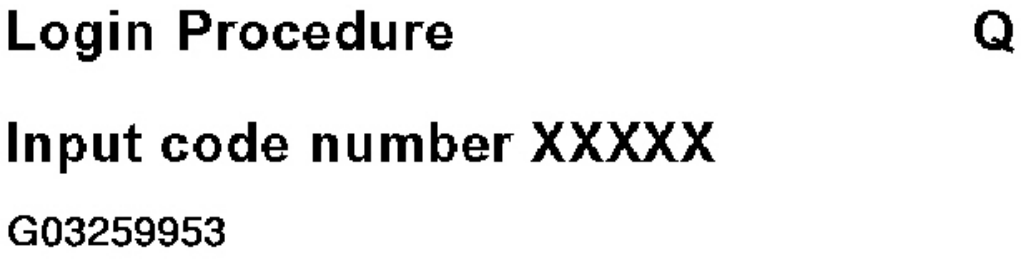


**Fig. 11: Identifying Expansion Tank (Vehicles With Max. Tank Marking)**
**Courtesy of VOLKSWAGEN OF AMERICA, INC.**

- Fit expansion tank cap.
- Switch off heater and air conditioner.
- Start engine and maintain an engine speed of about 2000 RPM for approx. 3 minutes.
- Run engine until coolant fan starts.
- Switch off ignition.

**WARNING: Steam can be released when removing the cap from the expansion tank. Cover the cap with a cloth and open carefully.**

- Check coolant level and top up if necessary.

  When engine is at normal operating temperature, coolant level must be on max. mark.

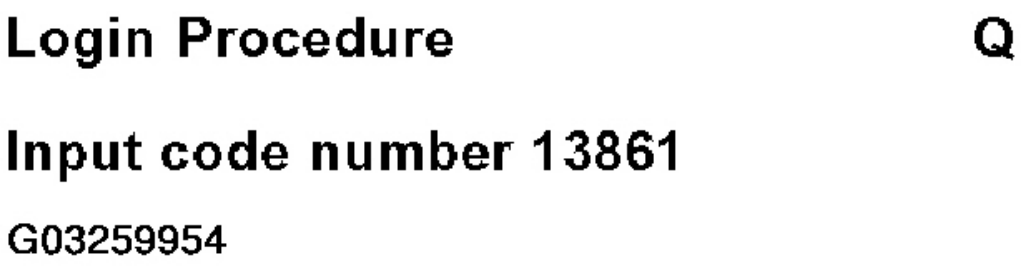


**Fig. 12: Identifying Expansion Tank (Vehicles With Max. Tank Marking)**
**Courtesy of VOLKSWAGEN OF AMERICA, INC.**

When engine is cold coolant level must be between min. and max. marks.

**Vehicles without max. expansion tank marking**

- Fill coolant slowly up to upper hatched field mark (arrow) on expansion tank.

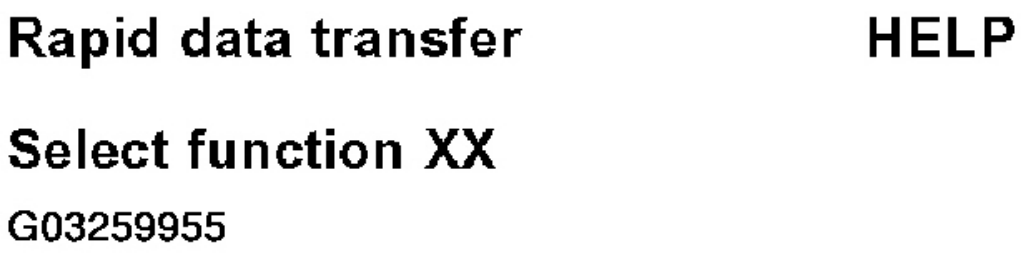


**Fig. 13: Identifying Expansion Tank (Vehicles Without Max. Tank Marking)**
**Courtesy of VOLKSWAGEN OF AMERICA, INC.**

- Close expansion tank.
- Switch off heater and air conditioner.
- Start engine and maintain an engine speed of about 2000 RPM for approx. 3 minutes.

- Run engine until coolant fan starts.
- Switch off ignition.

**WARNING: Steam can be released when removing the cap from the expansion tank. Cover the cap with a cloth and open carefully.**

- Check coolant level and top up if necessary:

  Coolant level must be at upper hatched field mark when engine is at operating temperature (arrow).

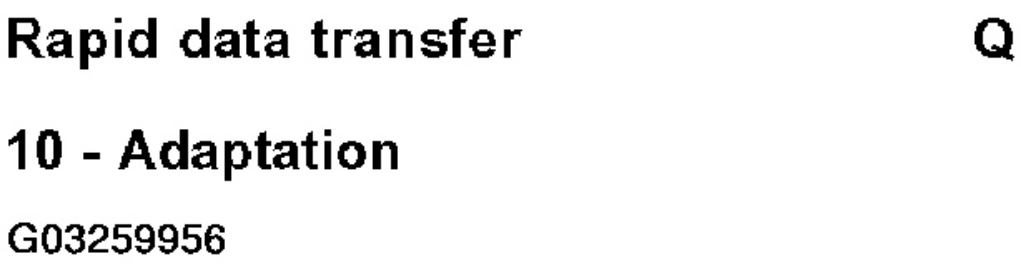


**Fig. 14: Identifying Expansion Tank (Vehicles Without Max. Tank Marking)**
**Courtesy of VOLKSWAGEN OF AMERICA, INC.**

When engine is cold coolant level should be around middle of hatched field.

**Filling coolant system with charging unit VAS 6096**

- Screw adapter V.A.G1274/8 onto expansion tank.
- Fill coolant system using coolant system charging unit VAS 6096:

  See Instruction manual for coolant system charging unit VAS 6096

**RADIATOR, REMOVING AND INSTALLING**

**Special tools, equipment, testers, measuring instruments and auxiliary items required**

- T10007 Refractometer
- V.A.G 1306 Drip tray
- V.A.G 1331 Torque wrench (5...50 N.m)
- VAS 5024 Assembly tool for spring-type clamps

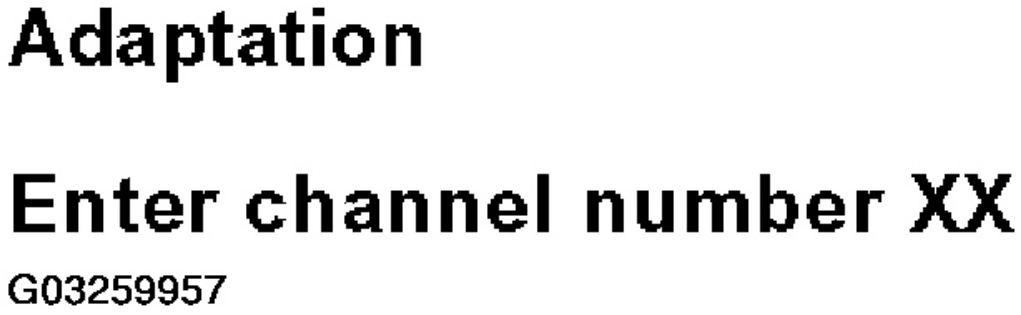


**Fig. 15: Identifying Special Tools**
**Courtesy of VOLKSWAGEN OF AMERICA, INC.**

**Removing**

- Drain coolant, See **COOLING SYSTEM, DRAINING AND FILLING**
- Pull connectors off thermal switch -1- and coolant fan -2-.
- Remove front end:

  See **FRONT END, ASSEMBLY OVERVIEW** .

- Remove lock carrier:

  See **LOCK CARRIER, ASSEMBLY OVERVIEW** .

- Pull coolant hoses quick release couplings off radiator.

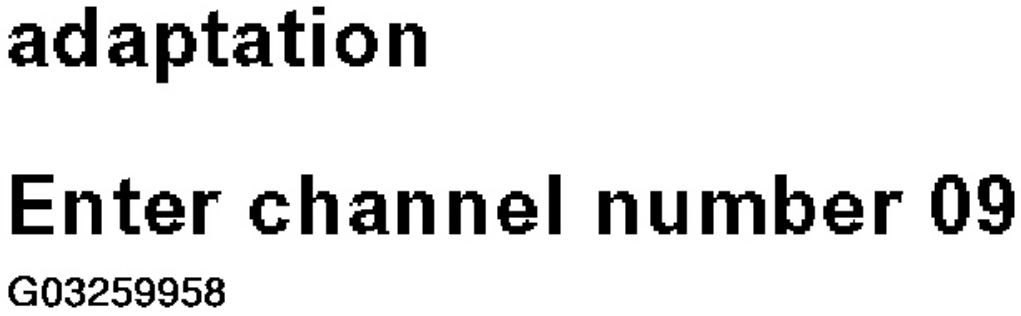


**Fig. 16: Disconnecting Thermal Switch And Coolant Fan Connectors**
**Courtesy of VOLKSWAGEN OF AMERICA, INC.**

**Models with air conditioning**

- Observe additional information and removal work, See **Additional information and assembly work on models with an air conditioning system** .

**Continuation for all models**

- Remove radiator securing bolts and take out radiator.

**Installing**

Install in reverse sequence. Note the following points:

- Check electrical connections and routing:

  See appropriate SYSTEM WIRING DIAGRAMS article

- Refill with coolant, See **COOLING SYSTEM, DRAINING AND FILLING** .

**Additional information and assembly work on models with an air conditioning system**

**CAUTION: The air conditioning refrigerant circuit must not be opened.**

**NOTE: To prevent damage to the condenser as well as to the refrigerant lines/hoses, ensure that the lines and hoses are not stretched, kinked or bent.**

- Remove retaining clamp(s) from refrigerant lines.
- Secure radiator to body before removing lock carrier.
- Remove condenser from radiator and secure to lock carrier.

**COOLANT FAN, CHECKING**

**Engine codes AEG, AVH, AZG**

**Special tools, equipment, testers, measuring instruments and auxiliary items required**

- V.A.G 1594 Adapter set
- Wiring diagram

**Fig. 17: Identifying Special Tool**
**Courtesy of VOLKSWAGEN OF AMERICA, INC.**

**Requirements**

- Main fuses must be OK
- Coolant Fan Control (FC) thermal switch -F18- OK

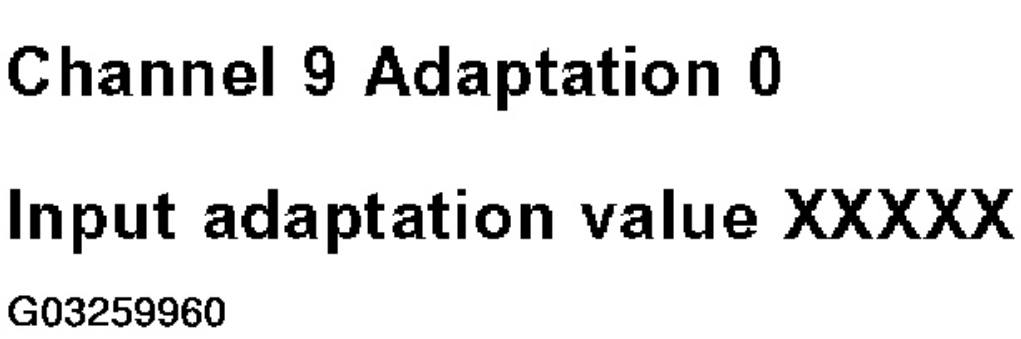


**Fig. 18: Locating Main Fuses (Left Front Corner Of Engine Compartment)**
**Courtesy of VOLKSWAGEN OF AMERICA, INC.**

**Work sequence**

- Remove left side sound insulation:

  See **NOISE INSULATION, ASSEMBLY OVERVIEW** .

- Disconnect 3-pin connector from Coolant Fan Control (FC) thermal switch -F18-.
- Bridge contact -1- and contact -2- of connector with auxiliary cables from V.A.G 1594 A.

Connector type A

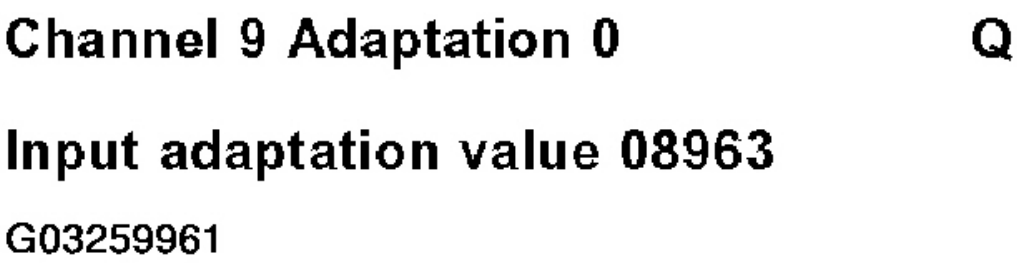


**Fig. 19: Identifying Coolant Fan Connector Type A**
**Courtesy of VOLKSWAGEN OF AMERICA, INC.**

Connector type B

**Fig. 20: Identifying Coolant Fan Connector Type B**
**Courtesy of VOLKSWAGEN OF AMERICA, INC.**

Connector type C

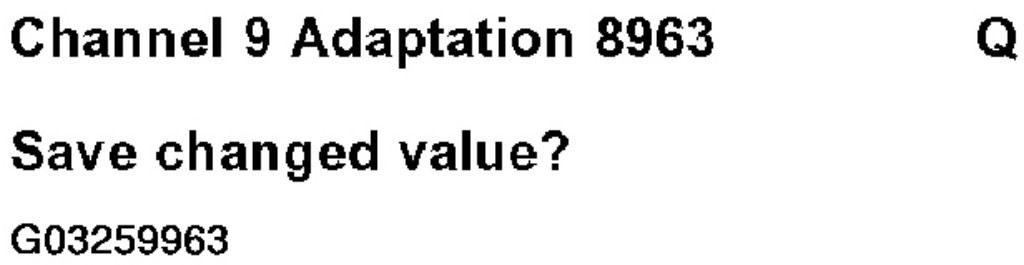


**Fig. 21: Identifying Coolant Fan Connector Type C**
**Courtesy of VOLKSWAGEN OF AMERICA, INC.**

1st speed for Coolant fan -V7- and Right coolant fan -V35- must start

- Switch on ignition.
- Bridge contact -2- and contact -3- of connector with auxiliary cables from V.A.G 1594 A.

  2nd speed for Coolant fan -V7- and Right coolant fan -V35- must start.

If 1st or 2nd speeds of fans do not run:

- Locate and eliminate open circuit using wiring diagram:

See appropriate SYSTEM WIRING DIAGRAMS article.

If no wiring fault is detected:

- Replace Coolant fan -V7- or Right coolant fan -V35-.

## COOLANT PUMP, REMOVING AND INSTALLING

### Special tools, equipment, testers, measuring instruments and auxiliary items required

- T10007 Refractometer
- V.A.G 1306 Drip tray
- V.A.G 1331 Torque wrench (5...50 N.m)
- VAS 5024 Assembly tool for spring-type clamps

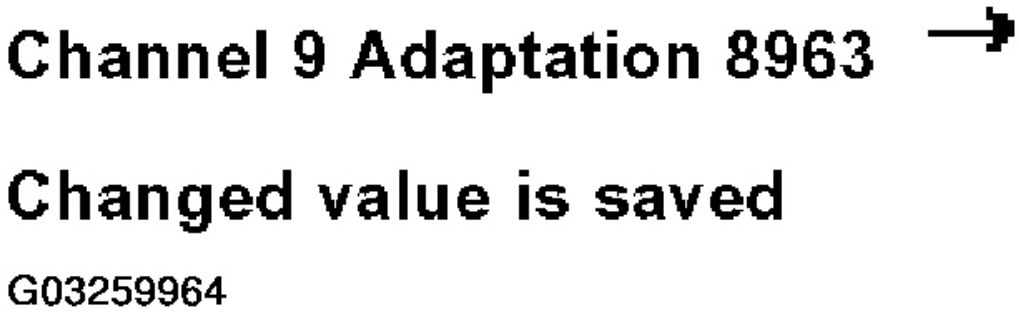


**Fig. 22: Identifying Special Tools**
**Courtesy of VOLKSWAGEN OF AMERICA, INC.**

### Removing

**NOTE:**

- **Always replace seals and gaskets.**
- **The lower section of the toothed belt guard need not be removed.**
- **The toothed belt should be left in position on the crankshaft pulley.**
- **Cover the toothed belt with a cloth to protect it from coolant before removing the coolant pump.**

- Drain coolant, See **COOLING SYSTEM, DRAINING AND FILLING** .
- Remove ribbed belt, See **RIBBED BELT, REMOVING AND INSTALLING** .
- Remove tensioning element for ribbed belt.

- Remove upper and center sections of toothed belt guard.
- Take toothed (timing) belt off coolant pump toothed belt pulley. See **TOOTHED BELTS, REMOVING, INSTALLING AND TENSIONING** .
- Unscrew securing bolt -1- for rear toothed belt guard -2-. See **Fig. 23** .
- Unscrew securing bolts -5- for coolant pump and remove coolant pump -4-.

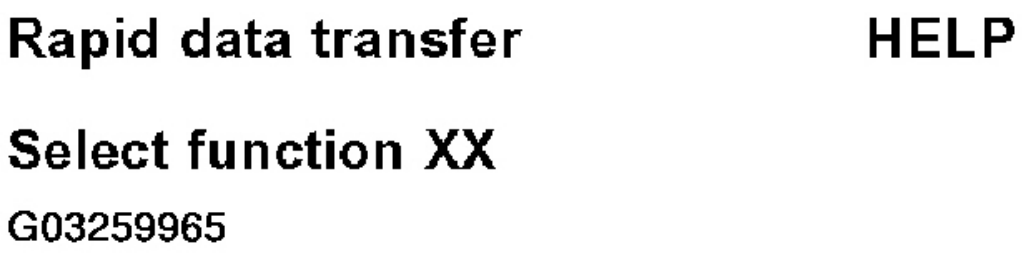


**Fig. 23: Removing Coolant Pump**
**Courtesy of VOLKSWAGEN OF AMERICA, INC.**

**Installing**

Installation is performed in the reverse sequence. Note the following:

- Moisten new O-ring -3- with coolant. See **Fig. 24** .
- Install coolant pump -4-. Installation position: Coolant pump sealing plug faces downward.
- Tighten securing bolts -5- to 15 N.m.
- Tighten securing bolt -1- for rear toothed belt guard -2- on cylinder head to 20 N.m

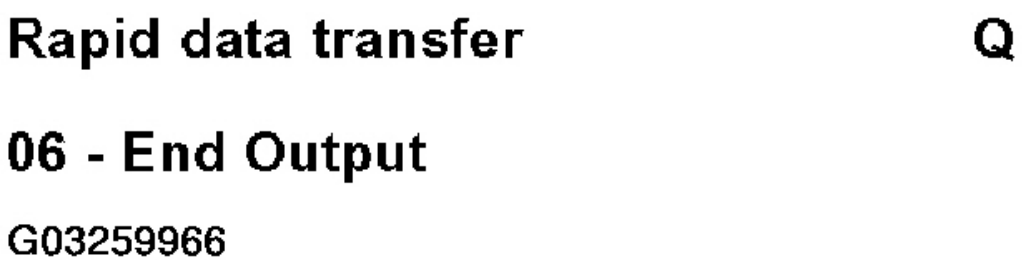

**Fig. 24: Installing Coolant Pump**
**Courtesy of VOLKSWAGEN OF AMERICA, INC.**

Installing toothed belt and adjusting timing. See **TOOTHED BELTS, REMOVING, INSTALLING AND TENSIONING** .

- Install ribbed belt tensioning element and torque to 25 N.m.
- Install ribbed belt. See **RIBBED BELT, REMOVING AND INSTALLING** .
- Fill with coolant, See **COOLING SYSTEM, DRAINING AND FILLING** .

## THERMOSTAT, REMOVING AND INSTALLING

**Special tools, equipment, testers, measuring instruments and auxiliary items required**

- T10007 Refractometer
- V.A.G 1306 Drip tray
- V.A.G 1331 Torque wrench (5-50 N.m)
- VAS 5024 Assembly tool for spring-type clamps

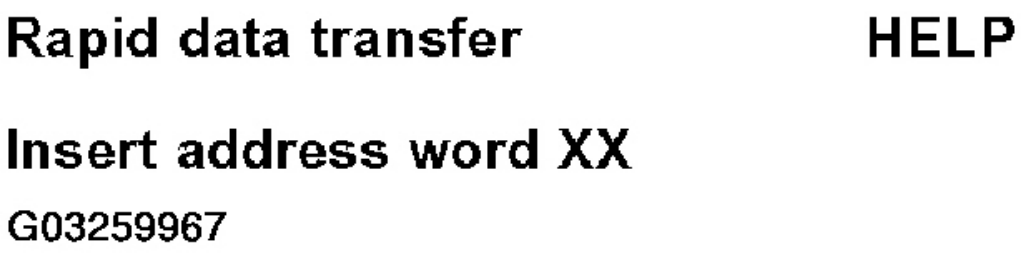


**Fig. 25: Identifying Special Tools**
**Courtesy of VOLKSWAGEN OF AMERICA, INC.**

**Removing**

**NOTE: Always replace seals and gaskets.**

- Drain coolant, See **COOLING SYSTEM, DRAINING AND FILLING** .
- Pull coolant hose off union -3-. See **Fig. 26** .
- Remove securing bolts -4- of union -3- and remove union -3- with thermostat -1-.

Rapid data transfer Q

17 - Instrument Cluster

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**Fig. 26: Removing And Installing Thermostat**
**Courtesy of VOLKSWAGEN OF AMERICA, INC.**

**Installing**

Installation is performed in the reverse sequence. Note the following:

- Moisten new O-ring -2- with coolant. See **Fig. 26** .
- Fit union -3- with thermostat -1- onto engine block.

**NOTE: The brace on the thermostat must be almost vertical.**

- Tighten securing bolts -4- to 15 N.m.
- Fill with coolant, See **COOLING SYSTEM, DRAINING AND FILLING** .